Electrostatic Beam Separators
Polarity Switches
Power Supplies
(WBS 2.7 & 2.3.7)

Rodger Bossert

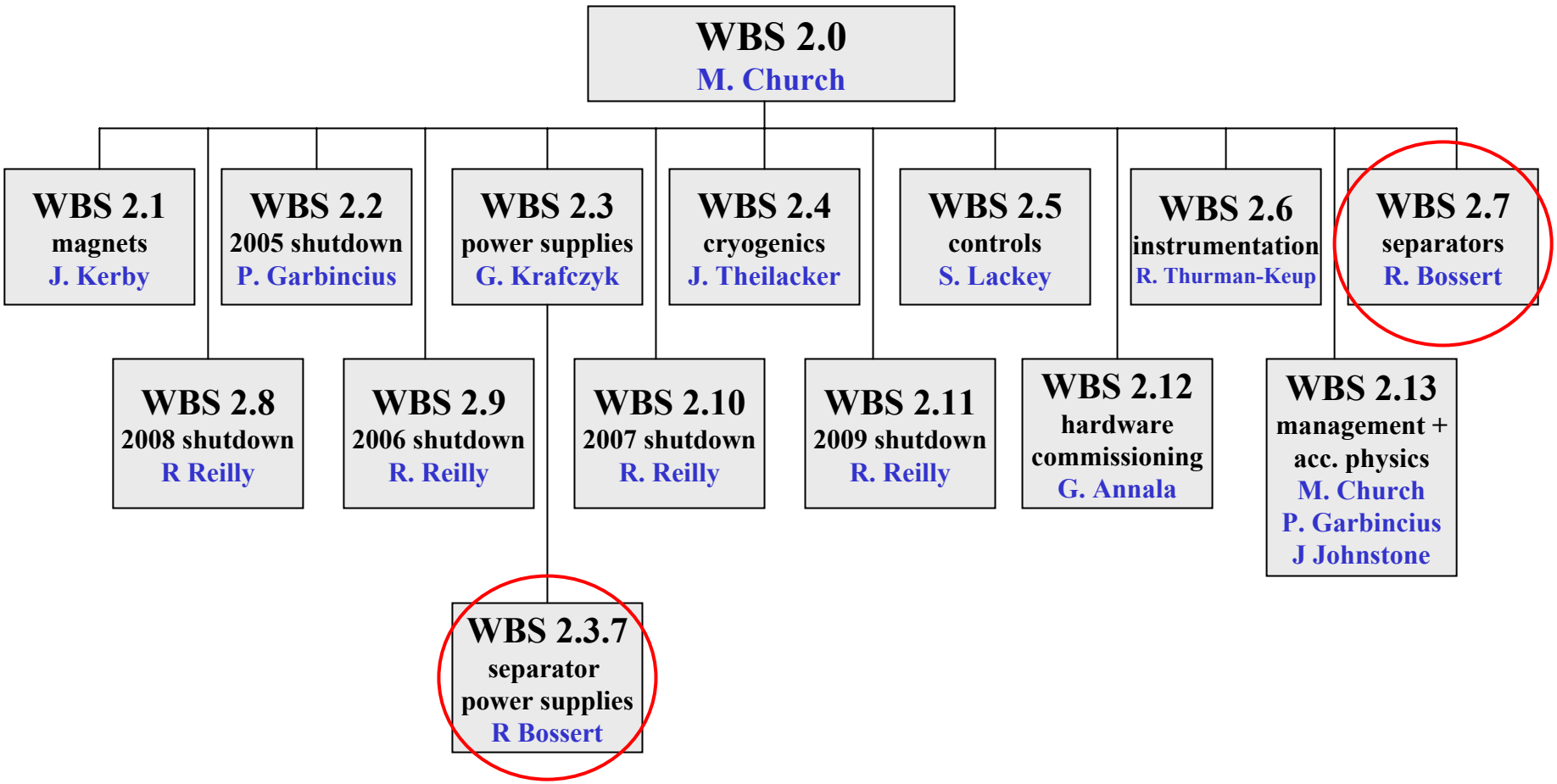
Overview

- Four electrostatic beam separators need to be built and installed as part of the BTeV project. These devices are identical to 29 separators already built for the Tevatron. Their purpose is to separate the proton/antiproton beams throughout the ring.

- There are presently 21 beam separators installed in the Tevatron main ring. There are 8 spares, four built by Technical Division in 2002 and four previously existing. Between 4 and 6 of the spares will be installed during Run IIb.

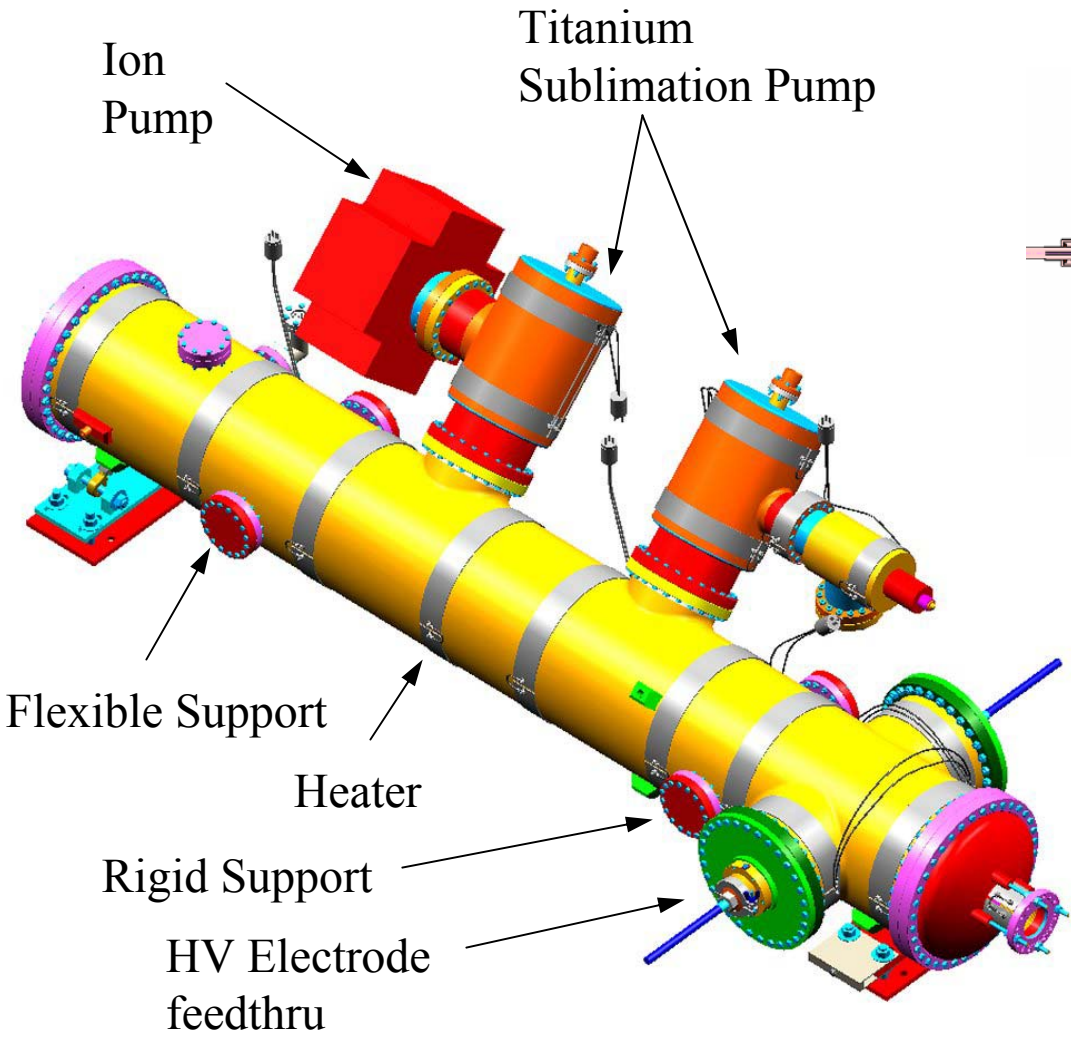
- In addition to the separators, 3 polarity switches and 3 power supplies will be needed. These units are also identical or nearly identical to many that have been previously built and installed in the Tevatron.

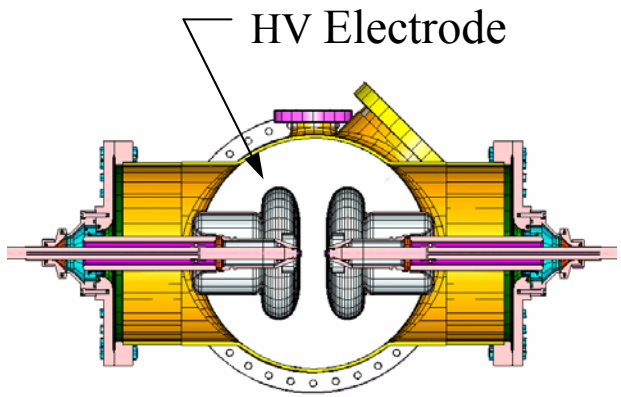
Organization



Separator Components

WBS 2.7 & 2.3.7





Electrostatic Beam Separators consist of two "parallel plates", separated by 5cm, with a potential difference of 200kv DC between them in operation. They can be constructed in either, "horizontal" and "vertical" configurations. The parts for each type are identical.

Polarity Switch Components

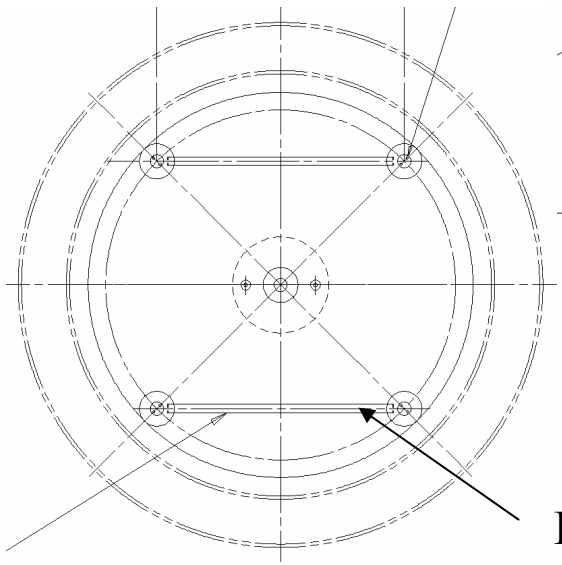
WBS 2.7 & 2.3.7

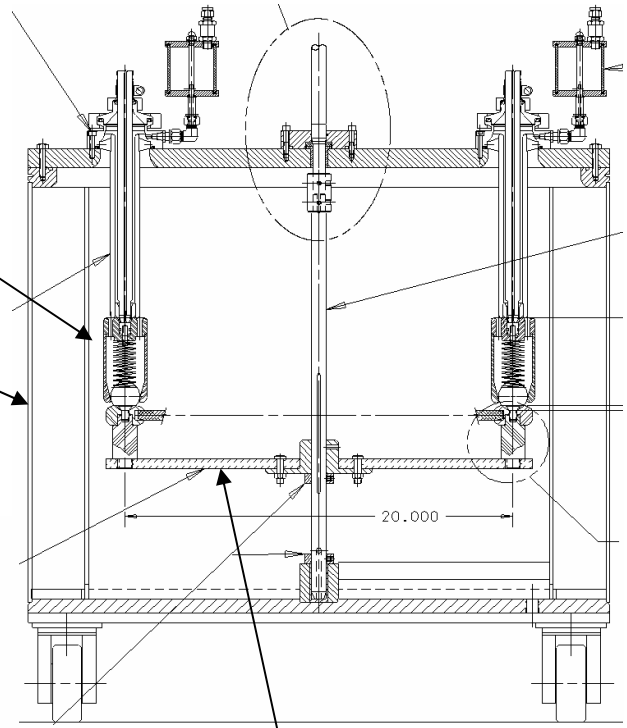
Geneva gearbox

High Voltage Feed Through

Tank filled with insulating oil

Motor





Turntable Assembly

Electrode

Power Supply System

Construction

WBS 2.7 & 2.3.7

- A factory for building beam separators is located at NWA. Major components include a clean room, ultrasonic cleaning system, vacuum pump-out system, baking oven, and a conditioning blockhouse for testing separators.
- R & D is presently being done to improve separator performance/reliability. A new factory is being constructed under TD management at MP9. Meanwhile, testing and rebuilding of separators is taking place in NWA with a combination of TD/AD employees.
- 12 Polarity switches are currently being constructed at MP9 by Technical Division. 2 are completed and currently being installed in the tunnel.
- 14 beam separator power supplies have been purchased and assembled. 12 have been installed and are operating in the tunnel. All have been done by Accelerator Division personnel.

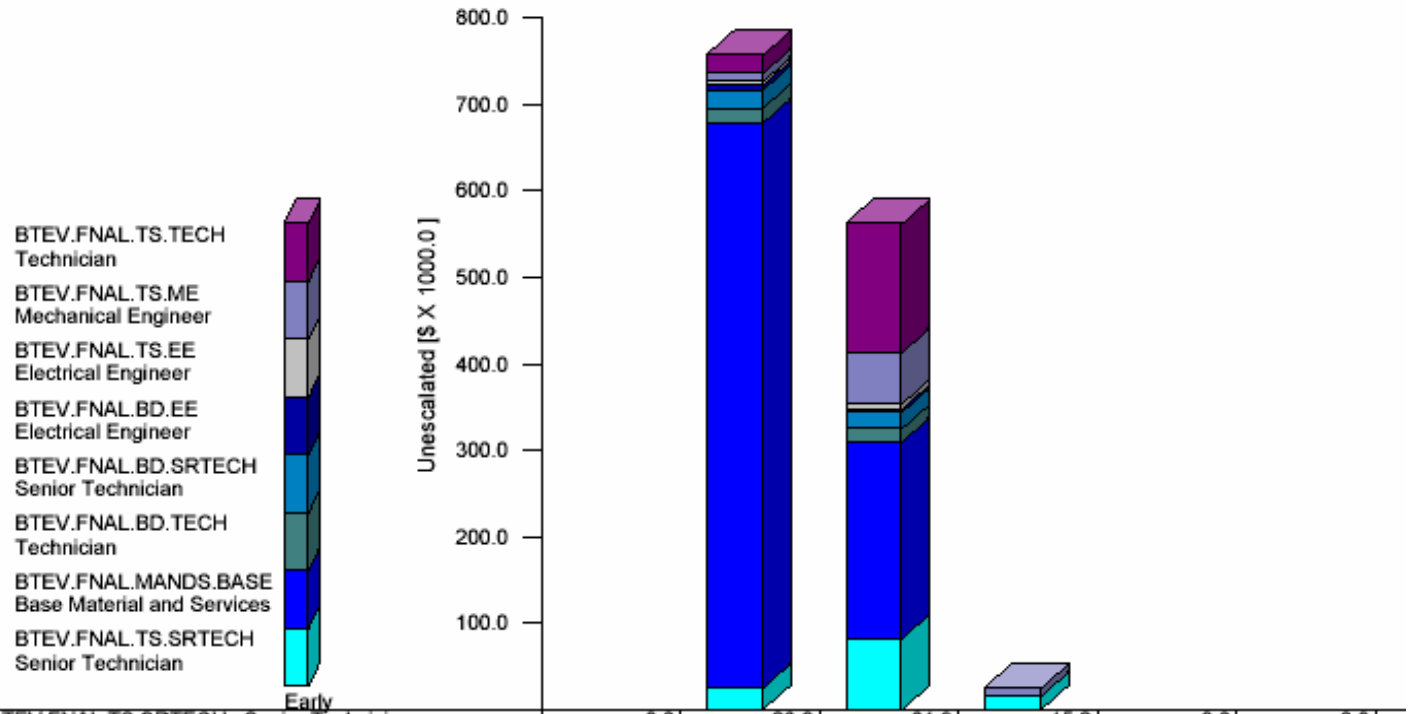
Construction Cost Breakdown WBS 2.7 & 2.3.7

WBS	Subproject	M&S (K$)	labor (K$)	total (K$)
2.3.7.1	separator power supplies	268.0	81.5	349.5
2.3.7.2	separator polarity switches	208.8	57.0	265.8
2.7.1	procure parts for separators	403.2	16.0	419.2
2.7.2	fabricate separators	0.0	270.9	270.9
2.7.3	test separators	0.0	34.7	34.7
	Total	**880.0**	**460.1**	**1340.1**

Total Cost Profile by Fiscal Year

WBS 2.7 & 2.3.7

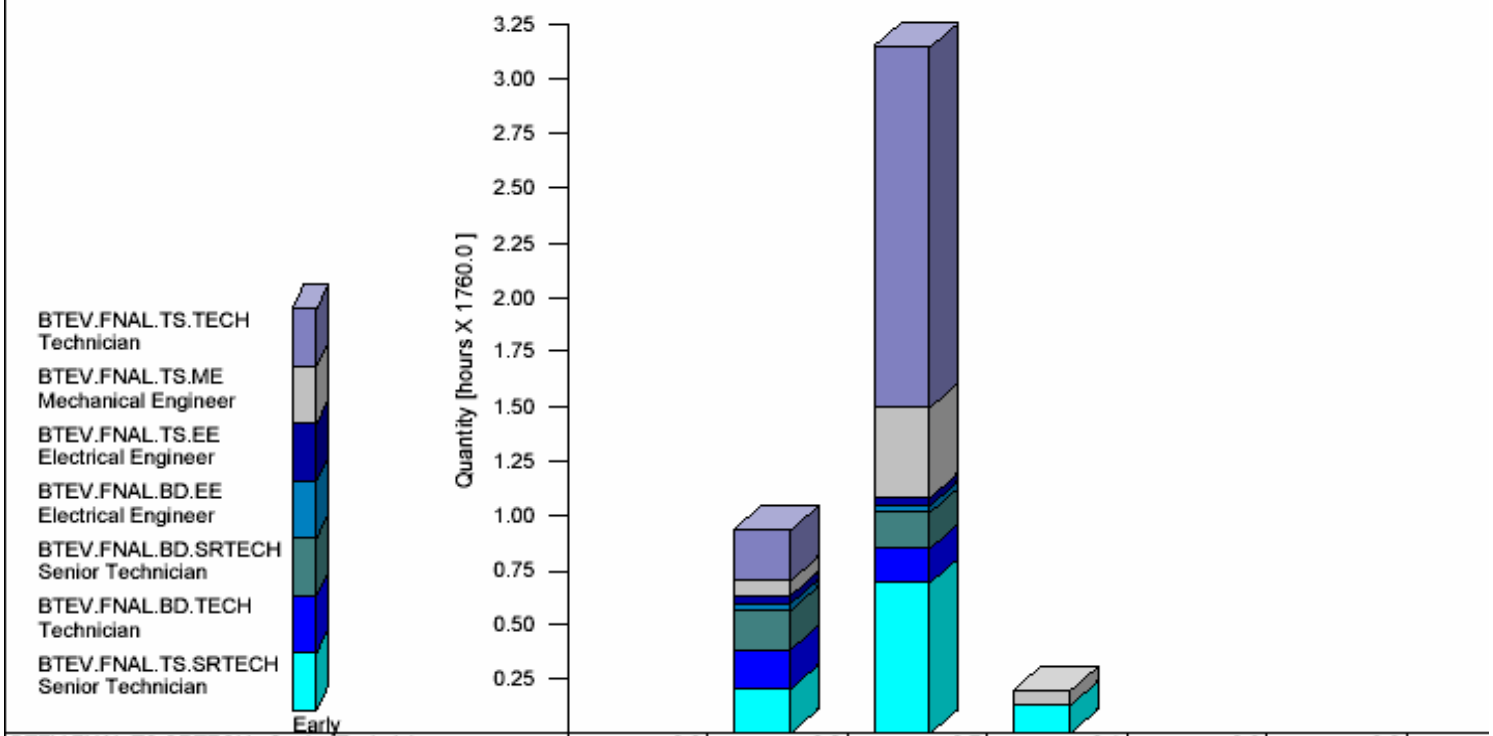
Activity ID	Activity Description	FY06	FY07	FY08	FY09	FY10	FY11
3	Power supplies	3					
7	Electrostatic separators	7					



BTEV.FNAL.TS.SRTECH : Senior Technician	0.0	23.6	81.9	15.2	0.0	0.0
BTEV.FNAL.MANDS.BASE : Base Material and Services	0.0	653.5	226.5	0.0	0.0	0.0
BTEV.FNAL.BD.TECH : Technician	0.0	16.1	14.6	0.0	0.0	0.0
BTEV.FNAL.BD.SRTECH : Senior Technician	0.0	21.4	19.3	0.0	0.0	0.0
BTEV.FNAL.BD.EE : Electrical Engineer	0.0	5.3	4.8	0.0	0.0	0.0
BTEV.FNAL.TS.EE : Electrical Engineer	0.0	5.3	4.8	0.0	0.0	0.0
BTEV.FNAL.TS.ME : Mechanical Engineer	0.0	9.4	59.3	9.1	0.0	0.0
BTEV.FNAL.TS.TECH : Technician	0.0	21.1	148.8	0.0	0.0	0.0

Labor Profile by Fiscal Year (FTE's) WBS 2.7 & 2.3.7

Activity ID	Activity Description	FY06	FY07	FY08	FY09	FY10	FY11	FY1
3	Power supplies	3						
7	Electrostatic separators	7						

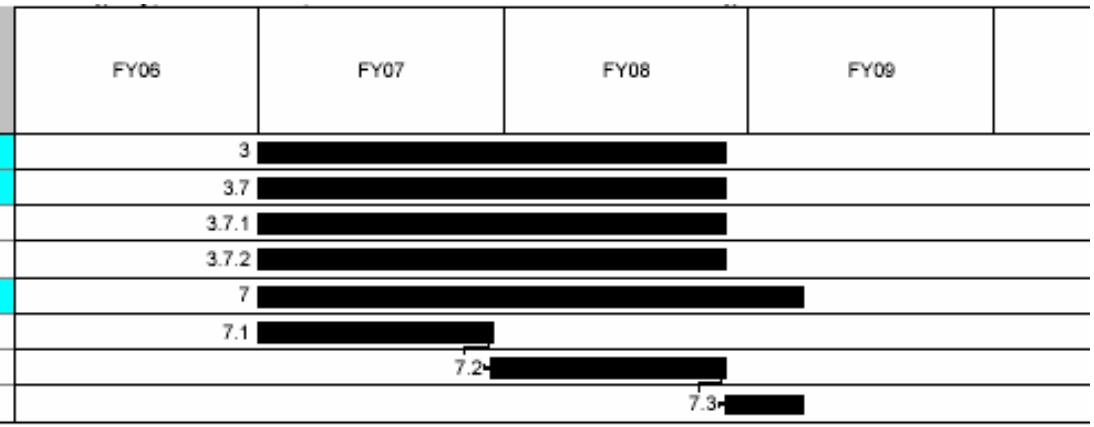


BTEV.FNAL.TS.SRTECH : Senior Technician	0.0	0.2	0.7	0.1	0.0	0.0	
BTEV.FNAL.BD.TECH : Technician	0.0	0.2	0.2	0.0	0.0	0.0	
BTEV.FNAL.BD.SRTECH : Senior Technician	0.0	0.2	0.2	0.0	0.0	0.0	
BTEV.FNAL.BD.EE : Electrical Engineer	0.0	0.0	0.0	0.0	0.0	0.0	
BTEV.FNAL.TS.EE : Electrical Engineer	0.0	0.0	0.0	0.0	0.0	0.0	
BTEV.FNAL.TS.ME : Mechanical Engineer	0.0	0.1	0.4	0.1	0.0	0.0	
BTEV.FNAL.TS.TECH : Technician	0.0	0.2	1.7	0.0	0.0	0.0	

Schedule

WBS 2.7 & 2.3.7

Activity ID	Activity Description
3	Power supplies
3.7	Separator supplies and switches
3.7.1	Power supplies
3.7.2	Polarity switches
7	Electrostatic separators
7.1	Procure parts for separators
7.2	Fabricate separators
7.3	Test new separators



Key Milestones

- Receive all separator parts – 01 Oct 07
- Receive all polarity switch and power supply parts 01 Oct 07
- Complete construction of first separator 01 Feb 08
- Test First Separator 15 Oct 08
- Complete all Polarity Switches and Power Supplies 01 Sep 08
- Complete Testing Separators 20 Dec 08

Risk Analysis

Risks concerning construction of electostatic beam separators, polarity switches and power supplies are very low. All three components have an established, proven, documented design, and have been operating reliably in the Tevatron. Facilities for building them exist. Personnel at Fermilab are experienced in building them.

Risk: New separators fail conditioning (traditionally, 50% of separators fail conditioning the first time)

Mitigation: Current R & D is focused on improving processes to alleviate this problem. Nevertheless, plan for time to rebuild at least 2 separators in case the current failure rate does not improve. Rebuild time is 2-6 weeks per separator. Also, there are expected to be be 2-4 completed spare separators for the Tevatron in place before production starts for BTeV.

Risk: People with experience in building these items will no longer be available at Fermilab.

Mitigation: Make sure complete, coherent drawings and travelers exist for all three components.

Summary

- Several items need to be built to support the BTeV project:
  - 4 electrostatic beam separators.
  - 3 polarity switches.
  - 3 power supplies.

- All have been designed, built, and presently operate reliably in the Tevatron.

- Facilities and expertise for building them exist within Fermilab.

- All can be done within the required BTeV schedule with very little uncertainty or risk.